PUTTING YOUR MICROCOMPUTER TO WORK

SCHOOL OF COMPUTER TRAINING

PROGRAMMING IN BASIC
STUDY UNIT 5

PUTTING YOUR MICROCOMPUTER TO WORK

STUDY UNIT 5
YOUR LEARNING OBJECTIVES

WHEN YOU COMPLETE THIS UNIT, YOU WILL BE ABLE TO:

☐ Set up and operate a microcomputer and CRT successfully . . . . **Pages 2–6**

☐ Enter BASIC commands and statements on the computer . . . . **Page 7**

☐ Obtain results from running programs . . . . **Page 8**

☐ Make corrections by inserting and deleting characters in a line . . . . **Pages 9–10**

☐ Use the PRINT command as a calculator . . . . **Page 11**

☐ Add and/or delete characters and lines to modify and customize programs **Pages 15–18**

☐ Use the FUNCTION and GRAPHIC modes on the computer to produce special keywords and graphic symbols . . . **Pages 19–20**

PUTTING YOUR MICROCOMPUTER TO WORK

---------- **DO YOU KNOW?** ----------

- What the difference is between a command and a BASIC statement?

- What it means to edit a statement?

- How to delete a line or a character from a BASIC statement?

- How to insert a line or a character into a BASIC statement?

INTRODUCING — YOUR MICROCOMPUTER

Now is the time to get your hands on your microcomputer. (You probably have checked it out already!) You should, however, read this complete lesson once before you start setting up.

You can learn from this lesson even without a computer, if you do not have a microcomputer right now. But you should get your hands on your microcomputer sooner or later (preferably sooner).

As soon as you obtain a microcomputer, you should be aware of some important DO's and DON'Ts regarding set-up and operation. You will be guided in detail later, but here are some important considerations now.

FIGURE 1—There are plenty of books and magazines pertaining to micros and BASIC available. It will be less confusing, however, to concentrate on the information provided in your lessons at this time. Once you have developed an understanding about your computer and these lessons, you can go forward and explore the many publications available with greater understanding.

These will help your learning process:

- Don't be afraid to experiment with your computer; you won't ruin it by pressing the wrong key.

- Don't treat your computer like a toy. Although it will take a considerable beating, a sledge hammer *will* break it!

- Do have fun with it. Remember, it's only an electronic machine. (Agreed, it is a sophisticated one!)

- Do have patience when programming. Programming, like typing, is a skill which cannot be mastered in one day. Every time you use your computer, you will discover something new. It won't be long before you will be the master of this exciting slave.

CHECKING OUT THE TIMEX SINCLAIR

Before setting up your new computer system, check to see that you have all of the following components:

☐ Timex Sinclair Computer.

☐ Power Adapter with Cord.

☐ CRT Computer Switch Box.

☐ CRT Connector Lead.

☐ Auxiliary Connector Leads.

☐ User Manual.

In addition to these system components, you will need a television set. It is recommended that you use a small black and white set as your TV monitor. This will work better with the Timex Sinclair, and it will project clearer images than the large color sets.

CONNECTING YOUR SYSTEM COMPONENTS

Develop good habits from the very beginning and you will save yourself a lot of time and grief. The first good habit is to take your time and make
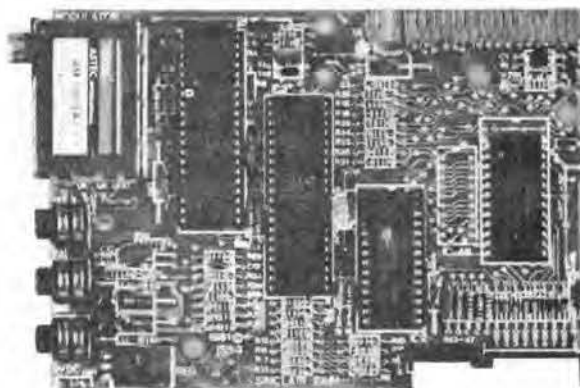
FIGURE 2—There is no need to take your computer apart to see what is inside. In fact, disassembly could harm the keyboard contact points and void your warranty. This is what you would see inside a typical Timex Sinclair computer.

sure every lead and plug are in their proper place. Then, be sure they are snug and out of harm's way. You don't want to be tripping over the connections!

Follow these steps to connect your system components.

Step 1. Disconnect the television set you plan to use for a CRT. Be sure that all components are disconnected from any power source.

Step 2. Begin by attaching the CRT Computer Switch Box to your TV's VHF antenna terminals. Attach the switch box to the surface of your TV by removing the paper from the back of the box and pressing it firmly to the TV.

Step 3. If you intend to use your TV for regular viewing, attach the VHF TV antenna leads to the bottom screws on the CRT Computer Switch Box.

Step 4. Plug your CRT Connector Lead into the top of the switch box, as shown in the illustration. Both ends of the Connector are exactly the same size, so it doesn't matter which end is used. Take care not to detach the box; grasp it firmly as the Connector lead is pressed into place.

NOTE: If you have cable TV (or a 75-OHM lead from your antenna), you will need to secure a "UHF/VHF Matching Coupling" device. This can be obtained from your local electronics store or from a television service company.

Step 5. Attach the other end of the CRT Connector Lead to your Timex Sinclair Computer in the hole marked "TV."

Step 6. Move the switch on the side of the CRT Computer Switch Box to "Computer" or in the "up" position. Later, when you want to use the TV for regular viewing, you can switch back to "TV."
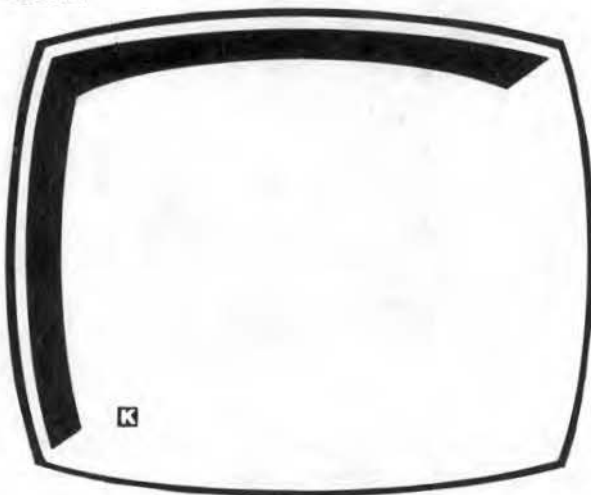
Step 7. Unravel the cord on the Power Adapter and insert the pin connector into the hole marked "9VDC" on your Timex Sinclair Computer.

Step 8. Insert the Power Adapter into the wall with the heavy end of the adapter down. Notice, too, that this adapter/transformer is designed for indoor use only!

Step 9. Plug in your TV's power supply. Check the CRT Computer Switch.

Step 10. Turn on the TV. Be sure to adjust the volume to "zero" to avoid an annoying hum.

Step 11. Since there is no on/off switch on the Timex Sinclair it is up and ready the moment it is plugged in. When the TV is turned on, you should see the cursor on the screen as shown below.

This is how our picture should appear. The cursor, which is a dark box with a "K" in the middle, will be the focal point for all activity when using the keyboard and monitor together.

Step 12. If the cursor does not immediately appear on the screen, unplug and then plug in the Power Adapter at the receptacle.

Step 13. If you have extreme interference, check the channel selector of the Timex Sinclair. Your computer will work on channel 2 or channel 3, whichever does not broadcast in your area. Try both to determine which gives you the best picture.

Step 14. Refine the picture by adjusting brightness and make other adjustments as necessary. If you are still having problems, review all steps and check all leads to ensure they are not loose.

NOTE: Nearby appliances can create static and affect operation of your computer. Be sure to keep the system away from them. Microwave ovens and other devices can also erase the magnetic tapes you will use, too, so it is wise to anticipate where you will store your cassettes.

Step 15. Place the Auxiliary Connector Leads (wire with two pin connectors on each end) in the drawer or on a shelf where you plan to store your cassette tapes. You will use these later when you begin using a tape deck or other peripherals.
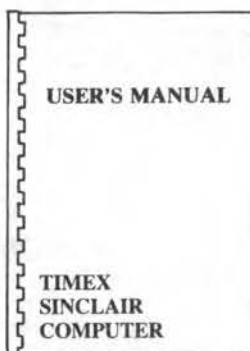
The combination of plugging in your computer and turning on the TV set "boots up" the system so that it can now receive instructions. Such commands are given and observed by using the keyboard and monitor.

DON'T LOSE YOUR MEMORY

Bumping or jarring your computer and connections can cause a disruption which will wipe out the program and data input. One way to avoid this problem is to use glue or double-sided tacky tape to fasten the computer to a work surface such as a small table, board or desk. A firm base is essential for ideal operation.
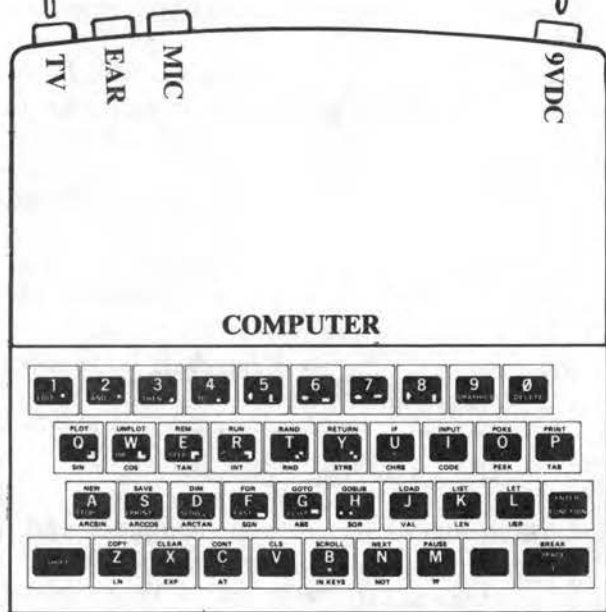

USER MANUAL
-Contains computer warranty, set-up instructions, sample programs, and report codes.

USER'S MANUAL

TIMEX SINCLAIR COMPUTER

CRT COMPUTER SWITCH BOX
-Enables you to connect video lead to your antenna lead. A switch will permit TV to be used as CRT or regular television.
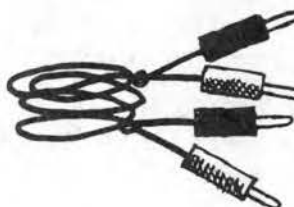
VHF CONNECTION

VHF ANTENNA CONNECTOR

CRT CONNECTOR LEAD ⟶
-Connects the computer to TV monitor. The pin connectors at each end of the black cord are the same size.

TV EAR MIC 9VDC

COMPUTER

AUXILIARY CONNECTOR LEADS
-Connects computer to tape deck for tape cassette usage.

DVE

TIMEX SINCLAIR COMPUTER
-Contains the keyboard and processor unit. Connector ports include TV, earphone, microphone, and power source.

POWER ADAPTER WITH CORD
-Converts regular AC voltage to nine volts DC power. This unit should be used indoors only.

FIGURE 3—Here are the components of your computer system. Put the auxiliary connector leads set away in a safe place for now. These leads will be user later with a tape recorder.

KEYBOARD REFERENCE
CHART

FIGURE 4—The special reference numbers above each key are used throughout this lesson. Place the Chart, or a copy of it, on a wall near your keyboard so you can check it at a glance.

THE KEYBOARD

The keyboard of your Timex Sinclair looks like a typewriter with a couple of important differences.

- Most keys represent more than one meaning.

- We do not need to use a shift key for capital letters, since all letters are entered in upper case only.

THE TV SCREEN

Your TV screen is now a CRT! In other words, the TV set has now become a special output device from your computer. The screen is divided into 22 horizontal rows or lines and 32 vertical columns.

Your screen is now composed of more than 704 "boxes" or spaces (the point where a column and a row intersect). Each space can display one character. Thus, 704 characters can be shown when all spaces are filled.

THE CURSOR

The cursor is the key to getting your magical genie—the computer—to do your bidding. Whenever a key is pressed, the corresponding character (or characters) is placed on the CRT exactly where the cursor was. The cursor then moves on to the next position.

When you see the "K" cursor, the computer is expecting you to enter a keyword. A keyword can be either a BASIC statement or a command.

THE "K" CURSOR

When you turn on the TV set and plug in the computer, the "K" cursor should appear in the lower left corner of the screen. If it does not, unplug and plug in your computer two or three times until it does appear. Also, if the cursor is difficult to see, unhook the VHF antenna connection from the switch box for a clearer picture.
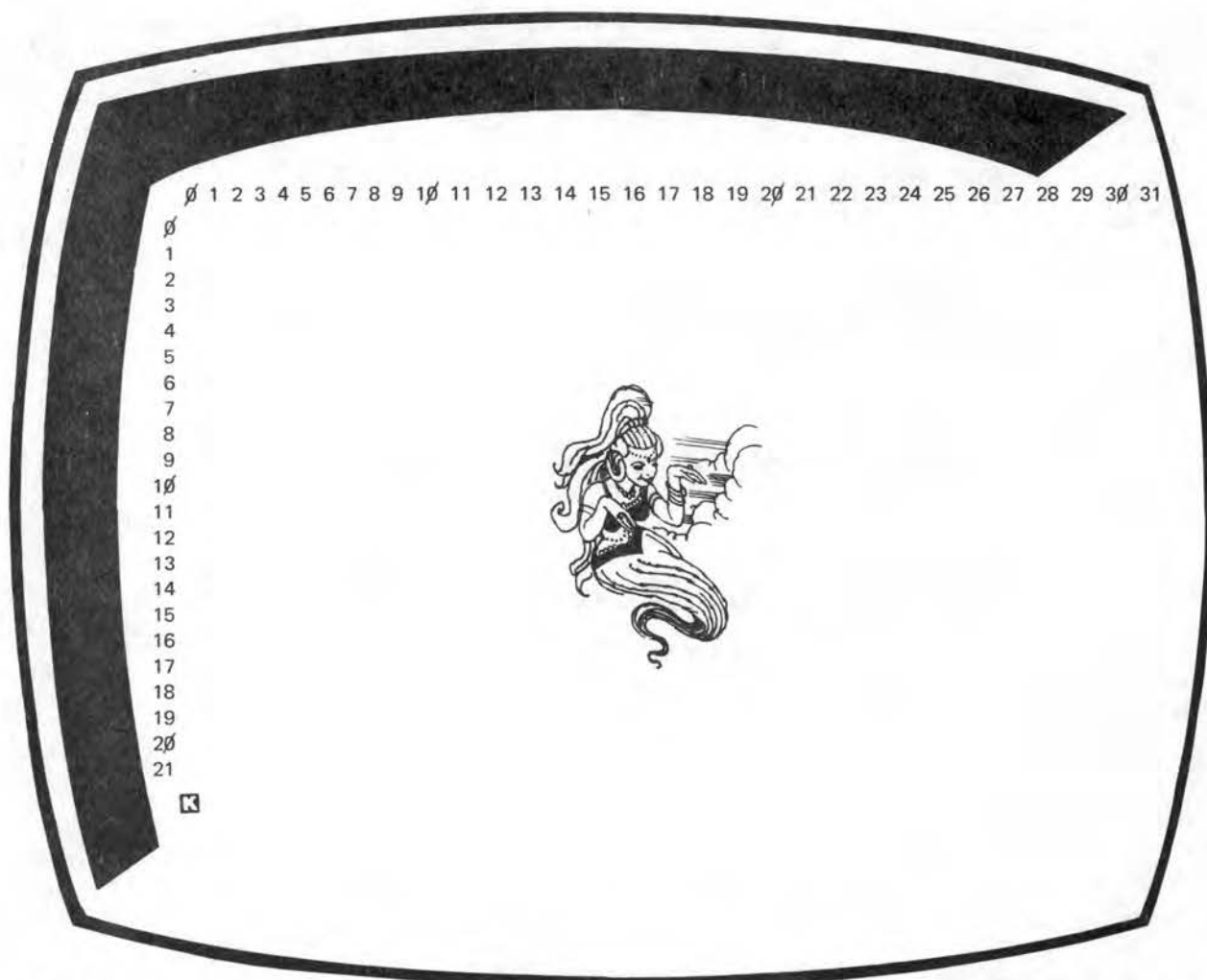

```
   Ø 1 2 3 4 5 6 7 8 9 1Ø 11 12 13 14 15 16 17 18 19 2Ø 21 22 23 24 25 26 27 28 29 3Ø 31
 Ø
 1
 2
 3
 4
 5
 6
 7
 8
 9
1Ø
11
12
13
14
15
16
17
18
19
2Ø
21
 K
```

FIGURE 5—The CRT is composed of lines and columns. The numbering always begins in the upper left corner at line Ø, column Ø. The bottom right corner is line 21, column 31. Note that there are actually two more lines at the bottom of the screen; these are reserved by the computer for entering BASIC statements and commands. You will soon see how this works.

FIGURE 6—The CURSOR has several different appearances which correspond to a variety of modes and instructions.

A **BASIC Statement** is a line that has a line number assigned to it. A statement gives the computer a direction to do something when the entire BASIC program has been entered and run.

A **Command** is a direction to the computer to do something immediately. Commands are given when you want an "instant" response.

As you learn more about BASIC Language, you will discover it contains many words and characters which can represent very complex computer functions. This "shorthand" reduces the time it takes to load programs and process data. One touch of a key can give you a lightning fast display of results on the CRT—as you will see very soon.

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ENTERING A COMMAND

Let's now try to enter a command. First, locate the "A" key (on the left side, third row), or Chart Key #21. Since the cursor is in the "K" or keyword mode, the word NEW will appear on the screen when the A key is depressed. Notice that the word NEW is printed just above the A key on your keyboard. In fact, all keys with keywords printed above them (Key numbers 11-29, 32-38, and 40) will display a keyword when pressed.

The NEW command is an instruction to the computer to clear all data stored in RAM.

PRESS Key #21, A.

Notice that the cursor has moved to the right of the word NEW and now has an "L" inside it instead of a "K." This, too, is part of the genie-like qualities of the Timex Sinclair. More will be said about the "L" cursor later. For now, let's press on!

PRESS Key #30, ENTER.

The ENTER key literally causes the command to be done.

Briefly, you have instructed the computer to clear RAM, then given a direct command for it to do what you wanted done. Did the screen flicker for a split second? Once ENTER was keyed in, the "K" cursor should have reappeared. This signals that RAM is clear and you are ready to proceed with another program.

 = KEYWORD

FIGURE 7—Whatever key you press when the "K" cursor is on, it will be a keyword command. Keywords include such commands as PRINT, RUN, RETURN, SAVE, PAUSE, and CLEAR.

Perhaps we should pause here and consider the matter of clearing the computer. When "booting up" many of the microcomputers on the market today, they must be cleared routinely before attempting to enter any data or programs. This is a precaution to ensure that RAM is ready to accept new input.

Actually, the Timex Sinclair automatically clears itself each time it is unplugged. Unplug the Power Adapter Cord from your computer (the pin connector at "9VDC") and see what happens. Insert it back. This action has caused RAM to be cleared. If you had a program and data entered before pulling the plug, it would have been lost.

So, when all else fails and you want to clear RAM, simply "pull the plug!" Maybe this is the time, too, for you to remind other members of the family and your friends **NOT TO EVER PULL THE PLUG ON MY COMPUTER!** because you may lose in 30 seconds what it may have taken you hours to produce.

WHAT'S NEW AND WHAT'S CLEAR

NEW wipes out the program and the variables! It is used when you want to load a brand new program.

CLEAR wipes out the variables and leaves the program! It is used when you want to process a different set of data using the same program.

FIGURE 8—It is essential that NEW and CLEAR be understood before using.

PRINTING NUMBERS

Now, let's enter another command. The PRINT command (Key #20) will cause characters to be printed at the top of the screen.

PRESS Key #20, PRINT.

The PRINT command will appear at the bottom of the screen. The result of having pressed #20 is that the magic cursor has moved one space to the right of the word PRINT. It also has the "L" inside of it again. And here is why.

When the cursor is in the "L" mode, the computer will use the white characters on the keyboard: the letters of the alphabet and numbers.

L = PRINT CHARACTERS

FIGURE 9—The "L" cursor allows you to use the letters, numbers, and other characters on the keyboard.

Suppose you want to print the number "15∅∅" at the top of the screen. You would enter the four digits by touching Key #1 once, Key #5 once, and Key #10 two times. Try it.
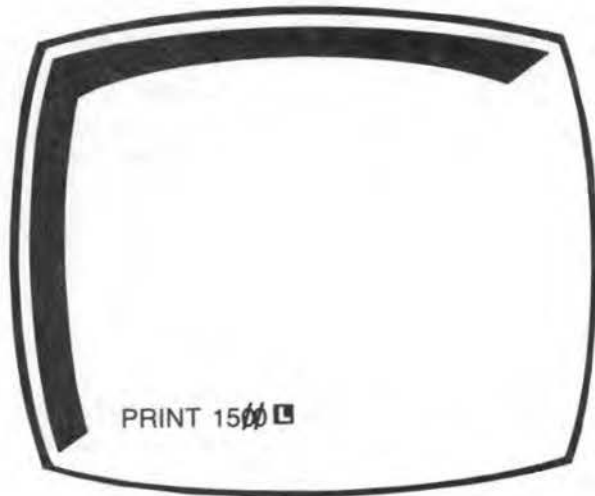
PRESS Key #1, one.

PRESS Key #5, five.
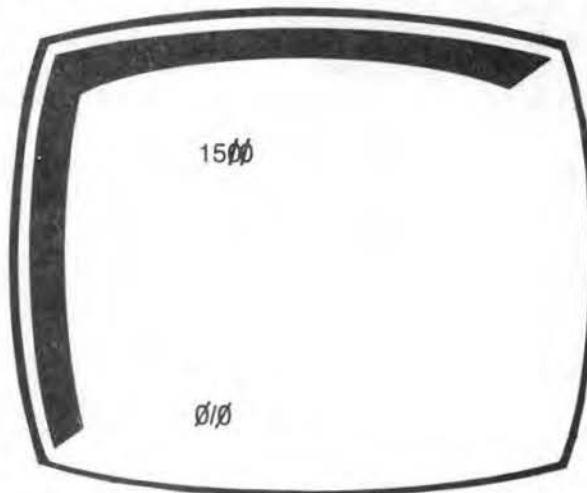
PRESS Key #10, zero.

once and again.

Your screen should look like this:

To enter your instructions into the computer, do this:

PRESS Key #30, ENTER.

Your screen should now look like this:

The computer has processed your command and printed the number 15∅∅ at the top of the screen. Notice the zeros have slashes through them. You will get into the habit of always putting slashes across zeros so they can be distinguished from the letter "O." Keep this in mind when writing programs.

At the bottom of the screen, you see "∅/∅." This is a report code. A list of report codes and their meanings can be found at the back of your Timex Sinclair User Manual.

The "∅/∅" report code shows successful completion of the command. If you now have anything else on the screen, something went wrong. What do you do before trying it again? Clear the memory by pulling out the power lead and plugging it back in again. Then, try it one more time.

PRINTING CHARACTERS
Let's try another PRINT command. Suppose we wish to print the words: "TIMEX SINCLAIR 15∅∅" on the top portion of the screen. Here's how:

PRESS Key #21, NEW.

PRESS Key #30, ENTER.

When a report code is showing at the bottom of the screen, you can enter keywords without the "K" cursor being visible.

PRESS Key #20, PRINT.

Since the information we wish to display is *not* a number (or a variable), we must enclose the characters within quotation marks ("). Notice that, also on Key #20, below the letter "P" are quotation marks in black.

In order for us to print them, the "L" cursor must be showing. It is. Proceed as follows:

HOLD DOWN Key #31, the SHIFT Key.

and . . .

PRESS Key #20, QUOTATION MARKS.

The quotation marks ought to appear on the screen. Holding down the SHIFT key places the keyboard into "shift" mode. Any key we depress while in this mode will display the black characters shown on the keys. Now, enter your message.

PRESS T, I, M, E, X.

PRESS Key #40 for SPACE.

PRESS S, I, N, C, L, A, I, R.
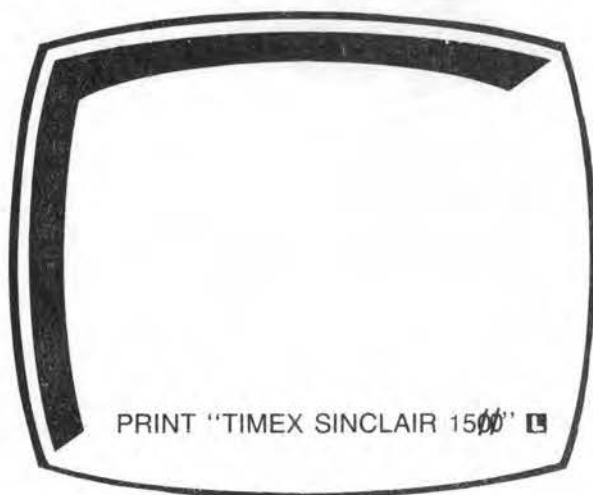
PRESS Key #40 for SPACE.

PRESS 1, 5, Ø, Ø.

HOLD DOWN Key #31, the SHIFT,

and . . .

PRESS Key #20, QUOTATION MARKS.

Your screen should now appear as follows:

PRINT "TIMEX SINCLAIR 15ØØ" ▣

PRESS Key #30. ENTER.

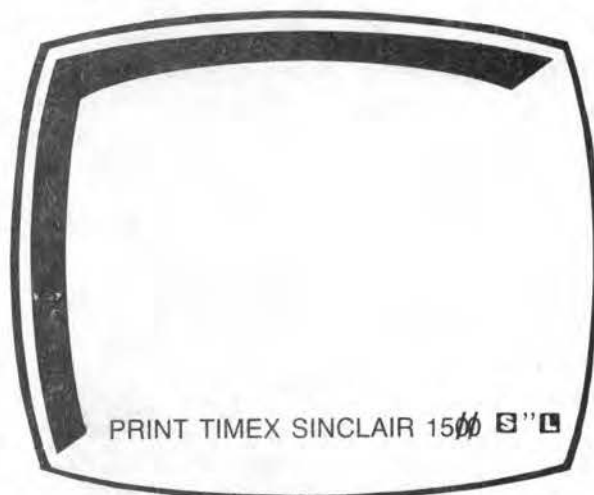Once again, the requested information appears on the screen along with the report code, Ø/Ø.

INSERTING CHARACTERS INTO A LINE

What happens when you enter a command incorrectly? Can you make a change easily? Here's how:

CLEAR the memory.

PRESS Key #20, PRINT.

ENTER the same characters as in the previous example *except* omit the first quotation marks. Here is what should appear on your screen:

PRINT TIMEX SINCLAIR 15ØØ ▣"▣

PRESS Key #30, ENTER.

What happened? Your command was not executed. The computer detected an error in the statement. Notice the command is still at the bottom of the screen. This time, however, there is a dark box with an "S" inside of it just before the quotation marks.

The "S" stands for **syntax** and is displayed whenever an invalid command or statement is entered. The genie is really telling you to try it again more carefully.

Being able to re-enter commands which have been given incorrectly is a tremendous timesaver. Imagine how it would be if an entire program was ruined because of one small error.

Of course, we know why we got the syntax error. The quotation marks at the beginning of the statement were intentionally omitted. Now, we need to insert quotation marks to the left of "TIMEX." The first step is to move the cursor to the space where the quotation marks are to be inserted.

Keys 5, 6, 7 and 8 are the "cursor control" keys. By using these, we can move the "L" cursor to the left, down, up or to the right *without* disturbing the characters we are moving over. Try it as follows:

HOLD DOWN Key #31, the SHIFT . . .

and . . .

PRESS Key #5 (CURSOR LEFT) once for each space to the left that you need the cursor to move.

You should have moved it 20 times. If you go too far, a shifted Key #8 will move the cursor to the right. Insert the quotation marks by entering a shifted Key #20 again. You will see that the quotation marks have been inserted into the character string.

PRESS Key #30, ENTER.

It worked!

The above method will also work before you receive the syntax error signal. But you have to develop a good habit to make it work every time. Before you hit the ENTER key, carefully examine the line you are about to give the computer. It is the same as proofing a report before taking it to the boss. If you have omitted something, it is very easy to correct before entering it.

But, what if you put in too much data or information? What if you needed to take characters out? The deleting of characters is much like the video games in which characters on the screen disappear. Let's try an example.

DELETING CHARACTERS
FROM A LINE
Follow these steps and be sure to insert the extra set of quotation marks as indicated.

CLEAR memory.

Enter the command:

PRINT "TOP OF THE SCREEN" "

Now . . .

PRESS Key #3∅, ENTER.

Ah, another syntax error! To delete a character, the cursor must be to the right of it. By luck, the cursor is already to the right of the error.

HOLD DOWN Key #31, the SHIFT,

and . . .

PRESS Key #1∅, DELETE.

The extra set of quotation marks should have vanished. Now . . .

PRESS Key #3∅, ENTER.

It worked again!

CHANGING CHARACTERS
ON A LINE
Not all errors, as we will see, are syntax errors. Misspelling a word within quotation marks, for example, will *not* be detected by the computer. Try this:

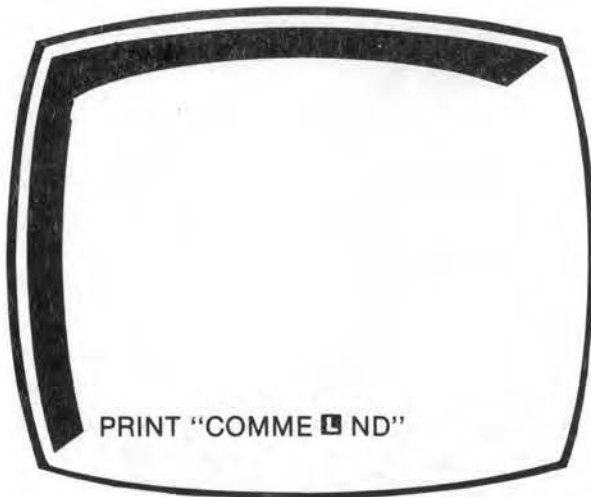CLEAR memory.

Enter the command:

PRINT "COMMEND"

If we were to press the ENTER key, the letters COMMEND would appear on the screen. But if we wish to print the word COMMAND (an A instead of an E), we need to change one letter. It can be done easily.

HOLD DOWN Key #31, the SHIFT . . .

and . . .

PRESS Key #5, CURSOR LEFT . . .

once for each space needed to move the cursor immediately to the right of the character to be changed.

The screen should look like this:

PRINT "COMME ▊ ND"

Can you delete the E? Remember the routine:

HOLD DOWN Key #31, the SHIFT . . . .

and . . .

PRESS Key #10, DELETE.

You can now make the change by inserting the A.

PRESS Key #21, the A.
PRESS Key #30, ENTER.

VOILA! It should have worked perfectly. If it did not, repeat the steps.

THE PRINT COMMAND AS A CALCULATOR

The print command can be used as a calculator. Try entering this:

CLEAR memory.

Enter the command:

PRINT 2 + 2

Can you find the plus sign (+)? The plus sign is a SHIFTED Key #28.

PRESS Key #30, ENTER.

Your screen should look like this:

4

Ø/Ø

Other arithmetic operations can be performed as well. A shifted Key #27 (–) is a minus sign; a shifted Key #36 (*) stands for multiplication; and, a shifted Key #35 (/) for division.

Using the techniques just learned, pause for a moment and take the Programmer's Check.

ENTERING A BASIC STATEMENT

Now that you are becoming familiar with the microcomputer system, it's time to enter BASIC statements. Each BASIC statement consists of two or three parts:

- A line number,

- a keyword, and

- the operands (optional).

An example of a BASIC statement is:

1Ø PRINT "BASIC"

Every BASIC statement begins with a line number such as the 1Ø in the example. The line number provides the sequence of each statement within the entire BASIC program.

Suppose we had three BASIC statements in a program. They might be numbered 1Ø, 2Ø and 3Ø. When the command to run this program is given to the computer, statement 1Ø will be executed first, followed by statement 2Ø, and then statement 3Ø.

Would it matter which statement had been entered first? No. You can enter BASIC statements in any order and the computer will automatically sort them out. Feeding BASIC statements in order of 2Ø, 3Ø and 1Ø will still result in them showing up on the screen as 1Ø, 2Ø, 3Ø.

The keyword, in this case PRINT, follows the line number. Many BASIC keywords are identical to our computer's commands. The only difference is that the BASIC statement is preceded by a line number and will be done when the program is run, while a command has no line number and will be done as soon as the command is entered.

The operands are the data that the computer is to act upon. In our example, the characters within the quotation marks, "BASIC" is what is to be printed on the screen. Some BASIC keywords require operands, and some do not.

When BASIC statements are designed to form a program, the logical flow of the program can be understood. Here is a very short BASIC program you can now enter into your computer. This program CLEARS the screen, PRINTS the word "BASIC" and THEN STOPS.

        1∅ CLS
        2∅ PRINT "BASIC"
        3∅ STOP

At first glance, it may seem odd that the line numbers are 1∅, 2∅ and 3∅ rather than 1,2,3. Although both methods will work, the first method (1∅,2∅,3∅) is preferred. This is because the 1∅,2∅,3∅ increments give us room to add more statements into the program, if we wish.

We could, for example, insert 18 more statements. How? Nine statements could be added starting with number 11 and ending at 19. Numbers 21 through 29 could also be inserted.

The ability to add new statements allows us tremendous flexibility and permits changes to be made quickly. Perhaps we have forgotten a statement or want to enhance the program at a later time.

To enter the program, do the following:

CLEAR memory.

With the "K" cursor on the bottom of the screen,

        PRESS Key #1, the one,

        PRESS Key #10, the zero.

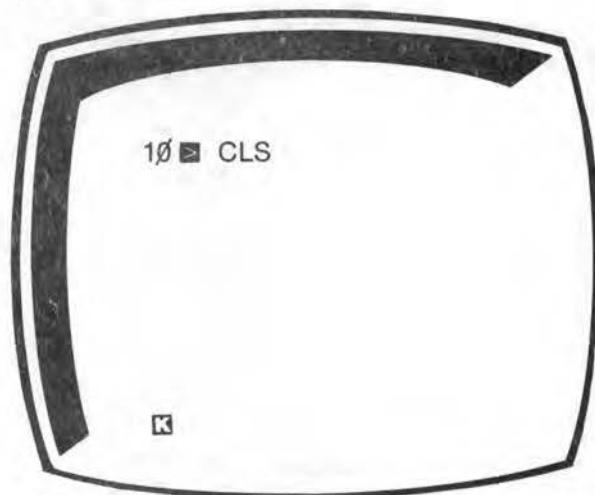Notice that the "K" cursor will allow you to either enter keywords or line numbers.

The "K" cursor should still be present to the right of the line number.

        PRESS Key #35, CLS

Now we have the "L" cursor, which allows us to enter operands. The CLS keyword, however, needs no operands, since it is a statement which will clear the screen prior to printing our output.

        PRESS Key #30, ENTER.

Rather than executing this statement, our line 1∅ now appears on the top of the screen and the "K" cursor is at the bottom.

= LAST LINE ENTERED

FIGURE 10—This cursor points to the last line entered. It will move down as each new line is added.

⊟ **NOTE: If the line number remains at the bottom of the screen with an "S" box, you have attempted to enter a statement incorrectly. Review the statement and make the appropriate changes and press ENTER again.**

Now the second BASIC statement is ready to be entered.

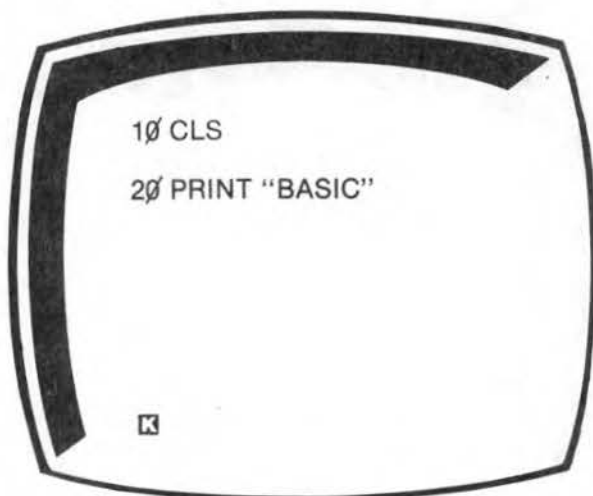   PRESS Key #2, two.

        PRESS Key #10, zero.

        PRESS Key #20, PRINT.

You should see the "L" cursor again. Enter the characters to print within quotation marks. Remember to use the shift key for the quotation marks.

        PRINT "BASIC"

        PRESS Key #30, ENTER.

Notice what happens. The second statement should be exactly under the first.

```
1Ø CLS

2Ø PRINT "BASIC"



K
```

The last line of the program, 3Ø STOP, can now be entered.

PRESS Key #3, three.

PRESS Key #1Ø, zero.

HOLD DOWN Key #31, SHIFT . . .

and . . .

PRESS Key #21, STOP.

PRESS Key #3Ø, ENTER.

The screen should look like this:

```
1Ø CLS
2Ø PRINT "BASIC"
3Ø STOP



K
```

Since the entire program has been entered, it is time to see whether it will work. Normally, a RUN command would initialize all the program variables. There are none in this program. After initializing, a RUN command then begins executing the program in the sequence indicated by the line numbers. Let's see what happens when the RUN command is given. **Remember, this is a command to do something immediately, so don't put a line number before it.**

PRESS Key #14, RUN.

The screen should appear like this:

```
1Ø CLS
2Ø PRINT "BASIC"
3Ø STOP



RUN  L
```

PRESS Key #3Ø, ENTER.

Surprise! This is what should be on your screen now:

```
BASIC




9/3Ø
```

Here is what happened. The RUN instruction directed the CPU to grab the first program line (1∅ CLS) and perform the function. Since CLS means "clear the screen," CPU did just that.

The next instruction was fetched (2∅ PRINT "BASIC"). The print instruction directed the computer to display the characters which were inside quotation marks ("BASIC").

The last instruction (3∅ STOP) instructed the computer that we wished to close the operation of this program. The report code (9/3∅) then appeared near the bottom of the screen.

PROGRAMMER'S CHECK ANSWERS

1

1. Refer to "Printing Characters" on Page 8, if you are not able to obtain correct input.

2. Refer to the text immediately following "Printing Characters" for assistance. This is most essential to learn. Practice, practice!

3. The procedures would be the following:

   PRESS Key #21, NEW
   PRESS Key #30, ENTER
   PRESS Key #20, PRINT
   PRESS Key #2,
   PRESS Key #4,
   HOLD DOWN Key #31, SHIFT and
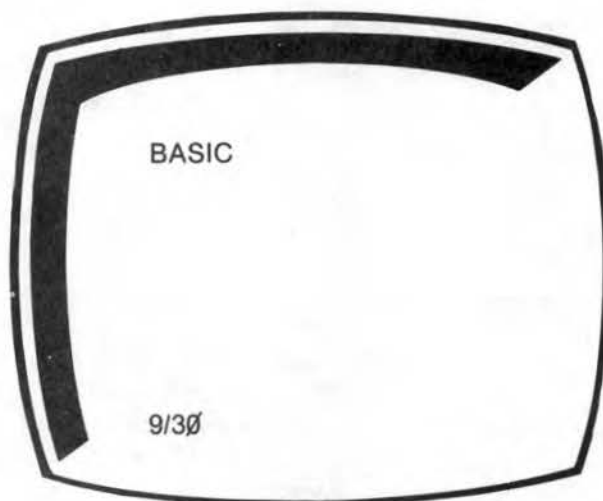   PRESS Key #28,
   RELEASE Key #31,
   PRESS Key #1,
   PRESS Key #2,
   PRESS Key #30, ENTER.

4. (D) Either "B" or "C."

5. (B) PRINT 1∅-2

6. (C) Appears at the bottom of the screen when a command is successfully completed.

The report code contains vital information for the programmer. The first number (9) informs us that a STOP has been encountered. The second number (3∅) shows the last line was executed.

Now let's see how we can make changes to the program. Keep in mind that if we turn the computer off, we lose the program.

EDITING A LINE OF A PROGRAM

One of the great advantages computers have over typewriters is complete editing capability. We can change or delete letters, characters, words or entire lines. Key #1, the EDIT key, is used to make quick work of editing. Once you understand the editing methods presented here, you will be able to double-check your programs and make corrections instantly.

Before changes can be made, the program must be called back onto the screen. Whenever a report code appears on the bottom of the screen, it is possible to recall a program by using the ENTER key.

PRESS Key #30, ENTER.

Let's change this program to print more information. Suppose we want to take our original program,

1∅ CLS
2∅ PRINT "BASIC"
3∅ STOP

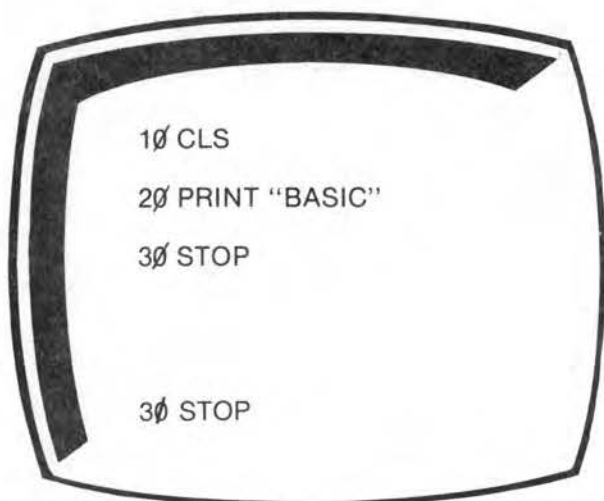and modify it so it looks like the following.

1∅ CLS
2∅ PRINT "BASIC"
3∅ PRINT "PROGRAM"
4∅ STOP

First, we need to change line 3∅. This can be done two different ways. We can enter a new line 3∅ on the bottom of the screen. When entered, the new line 3∅ would replace the old line 3∅. Instead, we are going to use another method.
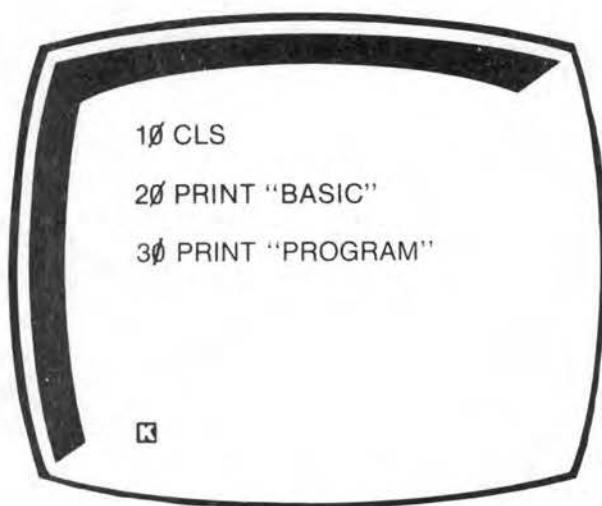
HOLD DOWN Key #31, SHIFT . . .
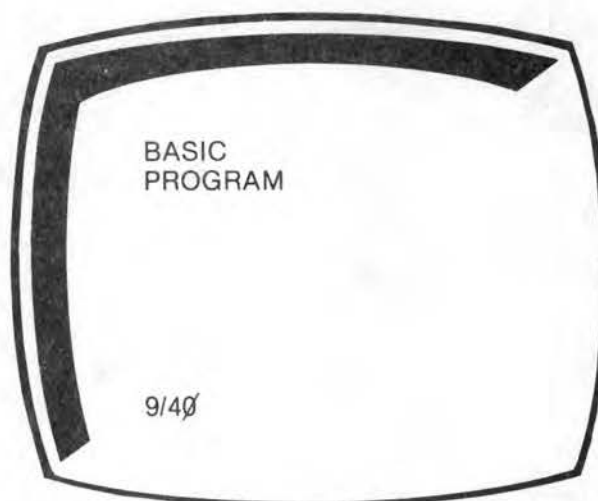and . . .
PRESS Key #1, EDIT command.

Look what has happened! A copy of line 3∅ is shown on the last line of the screen.

```
1∅ CLS

2∅ PRINT "BASIC"

3∅ STOP



3∅ STOP
```

```
BASIC
PROGRAM




9/4∅
```

We can now change this line. Move the "K" cursor to the right of the keyword STOP. Using the techniques learned earlier, DELETE the word STOP. (Use a shifted Key #10.) Enter the new keyword PRINT and then "PROGRAM". The changed program should look like this:

```
1∅ CLS

2∅ PRINT "BASIC"

3∅ PRINT "PROGRAM"



🄺
```

Now enter 4∅ STOP. Then, RUN the program as before. The output should be like the screen below.

Again the report code shows the STOP statement was encountered, but this time at line 4∅.

Although the CLS statement was unnecessary in this instance, it is good to get into the habit of using it. It will prove quite useful later on. Remember, the Timex Sinclair is automatically cleared. This next example will show this.

DELETING A LINE FROM A PROGRAM
It is relatively simple to delete an entire line from a BASIC program. Merely enter in the line number of the statement to be deleted.

PRESS Key #30. ENTER.

The ENTER will recall the program to the screen. Then, at the bottom of the screen, enter line number 1∅ and nothing else.

```
1Ø CLS

2Ø PRINT "BASIC"

3Ø PRINT "PROGRAM"

4Ø STOP



1Ø ▣
```

PRESS Key #30, ENTER.

Note that the program now starts with line 2Ø and line 1Ø has been deleted. RUN the program again.

PRESS Key #14, RUN.

Notice that the output appears exactly as before—proving that line 1Ø was not needed.

```
2Ø PRINT "BASIC"

3Ø PRINT "PROGRAM"

4Ø STOP



▣
```

MORE ON EDITING

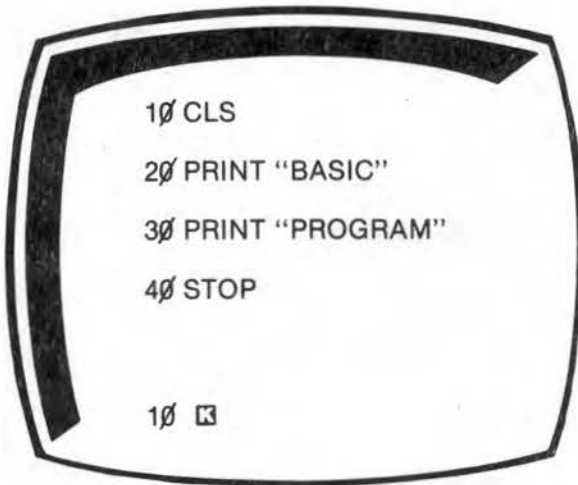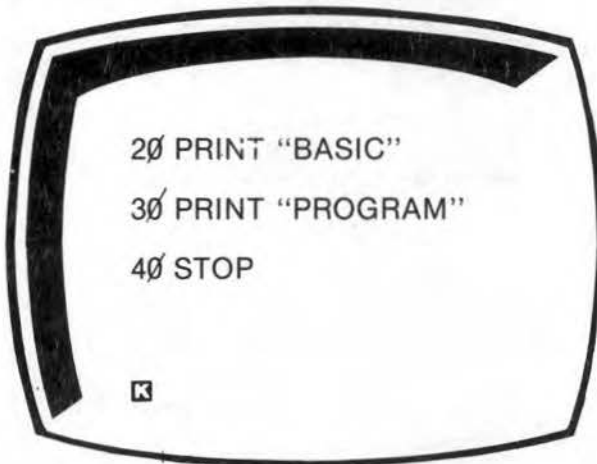Sometimes the box is not positioned beside the line we wish to change. Rather than reentering the entire line, experiment with the two methods which follow.

With the report code of 9/4Ø on the bottom of the screen, let's see whether we can change our two PRINT statements to this:

2Ø PRINT "EDITING"
3Ø PRINT "MADE EASY"
4Ø STOP

Method #1.

PRESS Key #30, ENTER.

The ENTER key will recall the program. Since the last line we modified was a deleted line (line 1Ø), the ▣ box is not visible. To position it beside line 2Ø, enter the following command: LIST 2Ø.

PRESS Key #28, LIST.
PRESS Key #2, TWO.
PRESS Key #10, ZERO.
PRESS Key #30, ENTER.

Now the ▣ box appears next to the line we wish to change. Use the EDIT command to change the characters.

HOLD DOWN Key #31, SHIFT . . .

and . . .

PRESS Key #1, EDIT.

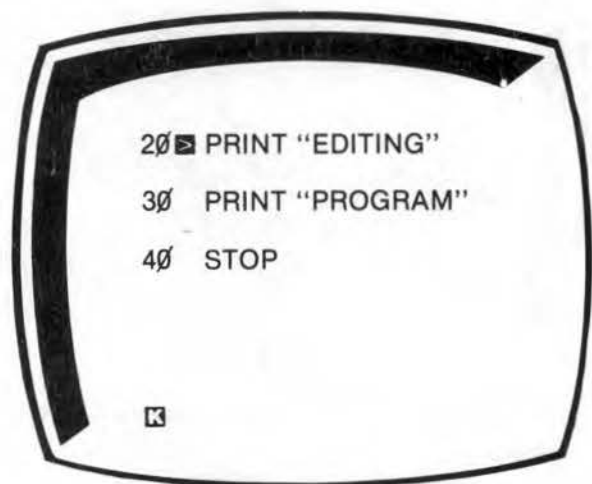You can go ahead and change the characters within the quotation marks to say EDITING instead of BASIC:

"E D I T I N G"

then . . .

PRESS Key #30, ENTER.

The line has now been changed.

```
2Ø▣ PRINT "EDITING"

3Ø   PRINT "PROGRAM"

4Ø   STOP



▣
```

Method #2.

We could change line 3∅ the same way as described in Method #1 (by LISTing line 3∅). But since the ▶ box is so close to line 3∅ (it is on the line 2∅), try this method:

HOLD DOWN Key #31, SHIFT . . .

and . . .

PRESS Key #6, CURSOR DOWN.

Notice that the ▶ box has moved down to line 3∅.

HOLD DOWN Key #31, SHIFT . . .

and . . .

PRESS Key #1, EDIT.

You can now proceed to edit the line and change it to read:

3∅ PRINT "MADE EASY"

then . . .

PRESS Key #3∅, ENTER.

PRESS Key #14, RUN.

The program now produces the new output.


```
EDITING
MADE EASY
```

9/4∅

NOTE: Entering a LIST command with no line number will automatically display the program starting with the first statement.

Now, let's check our progress. Do the Programmer's Check which follows and find out how much you remember.

PROGRAMMER'S CHECK

2

Entering Programs

Your success in programming is dependent upon your ability to create and enter programs on the computer. Learning how to input programs accurately and quickly requires considerable practice.

Use every opportunity to input and run programs. Below are three programs you can enter on your computer. If you have any difficulty, refer back to the text for assistance.

1. Write a program to print your name, address, city and state on the screen according to the format below:

   YOUR NAME
   ADDRESS
   CITY, STATE

   Hint: You will need *three* print statements.

2. Using the editing techniques you have learned, modify the above program to print the address of someone else.

3. Enter a four line program in reverse order (4∅, 3∅, 2∅, 1∅) and see whether the computer automatically arranges them in their proper order.

THE GRAPHIC AND FUNCTION MODES

On many computers, some instructions can only be accessed by shifting the computer into another "mode" of operation. It is very much like shifting gears on a car to obtain a set of different results.

On the Timex Sinclair, instructions located beneath the key can only be entered by shifting the keyboard into the FUNCTION mode. Try shifting. Here is how to do it:
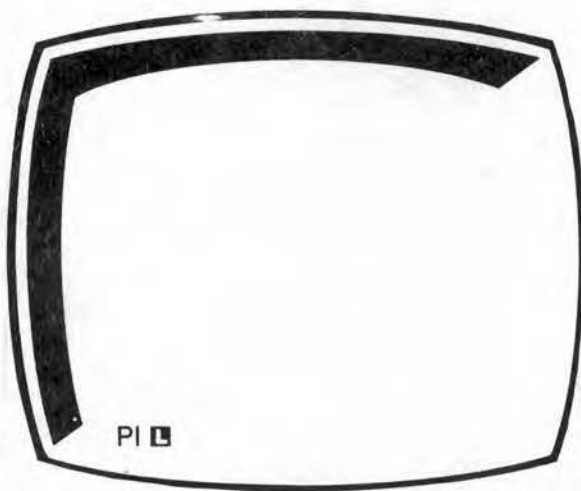
HOLD DOWN Key #31, SHIFT . . .

and . . .

PRESS Key #30, ENTER.

A shifted ENTER key becomes the FUNCTION key. The cursor will now be an "F" cursor. The next key you press will display the keyword function listed just under the various keys on the keyboard. Try it.

PRESS Key #38, PI.

In the FUNCTION mode, Key #38 reveals the function of PI for mathematical applications. Notice, too, that the cursor immediately changed back to regular mode after you used the FUNCTION. **The "F" cursor lasts for one key depression only.**

The computer is also capable of displaying graphics such as solid black or gray boxes, lines, and bars. You can access these graphics by locking the keyboard into GRAPHICS mode.

HOLD DOWN Key #31, SHIFT . . .

PRESS Key #9, GRAPHICS.

Symbol	Code	How obtained	Symbol	Code	How obtained
	0	K or L SPACE		128	SPACE
	1	G shifted 1		129	G shifted Q
	2	G shifted 2		130	G shifted W
	3	G shifted 7		131	G shifted 6
	4	G shifted 4		132	G shifted R
	5	G shifted 5		133	G shifted 8
	6	G shifted T		134	G shifted Y
	7	G shifted E		135	G shifted 3
	8	G shifted A		136	G shifted H
	9	G shifted D		137	G shifted G
	10	G shifted S		138	G shifted F

FIGURE 11—These graphic symbols can be used in a variety of ways to illustrate comparative data, designs and games. Experiment and try using the different symbols.

The cursor has now become a "G" or Graphics cursor. And unlike the FUNCTION mode, characters that are pressed will continue to be graphics characters until the keyboard is unlocked (shifted back to normal).
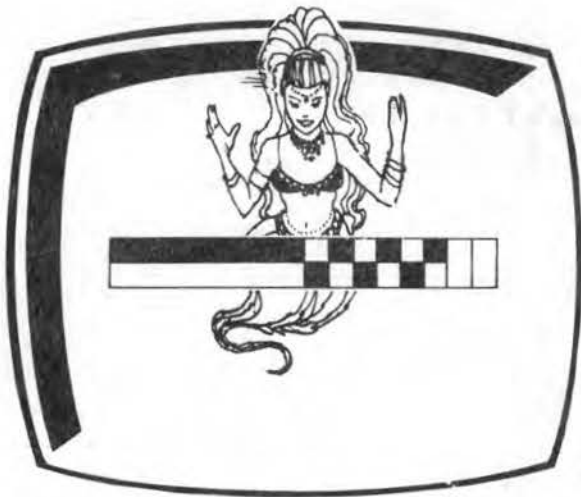
FIGURE 12—By holding down the SHIFT key while in GRAPHICS MODE, symbol keys can be pressed to create interesting patterns such as this one.

To get the cursor back to normal, merely press a shifted Key #9 again. But before doing so, take time to familiarize yourself with some of the graphics possibilities. Touch several keys to see the results.

As you can see, your computer has already become a powerful genie under your control. One touch and you can create a variety of commands, statements, and visible results. And this is only the beginning! Imagine what you can do after a bit more practice and skill development.

Meanwhile, take time to review what you have learned before taking the examination which follows. Practice connecting the microcomputer system components. Enter commands until you feel comfortable with ENTER, PRINT, RUN.

Practice deleting, adding, and changing characters, words and lines. Once you feel confident, try answering the questions posed at the beginning of the lesson to see whether you know the answers. If so, you are really prepared to complete the examination.

DO YOU KNOW NOW?

These were the questions posed at the beginning of the lesson.

● **What the difference is between a command and a BASIC statement?**
Although both statements and commands may share the same keywords, statements are executed when the program is run.

● **What it means to edit a statement?**
A statement is edited whenever it is changed. The line may be reentered to change it. We also may list it and bring it to the bottom of the screen where it can be changed.

● **How to delete a line or a character from a BASIC statement?**
Lines are deleted from a BASIC program by entering the line number with nothing on it. Characters are deleted from a line by moving the cursor to the right of the character and pressing the delete key.

● **How to insert a line or a character into a BASIC statement?**
Lines are inserted into a BASIC program by entering them with a line number which will put it into the proper sequence of the program. Characters can be inserted into a line by moving the cursor to the exact position at which the characters are to be inserted. Then, the appropriate keys are pressed and the characters are entered.

SCHOOL OF COMPUTER TRAINING

EXAM 5

PUTTING YOUR MICROCOMPUTER
TO WORK
24705-2

Questions 1-20: Circle the letter beside the one best answer to each question

1. A BASIC statement is *always* comprised of

   (a) a line number.
   (b) a keyword.

   (c) operands.
   (d) a line number and keyword.

2. A BASIC statement is executed

   (a) immediately.
   (b) after pressing CLEAR.

   (c) When the program is run.
   (d) only on graphics mode.

3. In order to change a line in a program, you might

   (a) Use the EDIT command.
   (b) move the ▧ box up or down.

   (c) reenter the line.
   (d) use all the answers given.

4. Which method will delete a line from a program?

   (a) Enter the line number
       with nothing on it.
   (b) Type in DELETE.

   (c) Use the DELETE Key (a shifted
       Key #10).
   (d) None of the answers given here.

5. In order to input quotation marks into the computer,

   (a) The "K" cursor must be showing.   (c) the "L" cursor must be showing.
   (b) the "W" cursor must be showing.   (d) the "S" cursor must be showing.

6. Whenever the "S" appears within a cursor box, it means

   (a) an improper statement or command is entered. (c) a statement is about to be printed.
   (b) the screen is being filled.   (d) the system is ready to run.

7. Which of the following commands will print the difference between 5ØØ and 5Ø?

   (a) PRINT "5ØØ"-"5Ø"   (c) PRINT 5ØØ-5Ø
   (b) PRINT "5ØØ-5Ø"""   (d) "PRINT" 5Ø-5ØØ

8. In order to display the sum of 46 and 22, you would

   (a) PRESS Key #20, PRINT   (c) PRESS Key #30, ENTER
       HOLD DOWN Key #31, SHIFT and   PRESS Key #20, PRINT
       PRESS Key #20, QUOTE MARKS   PRESS Key #20, QUOTE MARKS
       PRESS Key #4,   PRESS Key #4,
       PRESS Key #6,   PRESS Key #6,
       PRESS Key #40, SPACE and   PRESS Key #40, SPACE and
       PRESS Key #2,   PRESS Key #2,
       PRESS Key #2,   PRESS Key #2,
       PRESS Key #30, ENTER   PRESS Key #20, QUOTE MARKS
       PRESS Key #14, RUN   PRESS Key #30, ENTER

   (b) PRESS Key #21, NEW   (d) PRESS Key #21, NEW
       PRESS Key #30, ENTER   PRESS Key #30, ENTER
       PRESS Key #20, PRINT   PRESS Key #20, PRINT
       PRESS Key #2   PRESS Key #4
       PRESS Key #4   PRESS Key #6
       HOLD DOWN Key #31, SHIFT, and   HOLD DOWN Key #31, SHIFT, and
       PRESS Key #28   PRESS Key #28
       RELEASE Key #31   RELEASE Key #31
       PRESS Key #1   PRESS Key #2
       PRESS Key #2   PRESS Key #2
       PRESS Key #30, ENTER.   PRESS Key #30, ENTER.

9. When the NEW key is activated, then

   (a) the program and program variables are erased.
   (b) the program variables are erased, but the program remains.
   (c) the CLEAR keyword appears on the CRT screen.
   (d) the "S" flashes on the screen.

10. When the CLEAR key is activated, then

    (a) the program and program variables are erased.
    (b) the program variables are erased, but the program remains.
    (c) the NEW keyboard appears on the CRT screen.
    (d) the "S" flashes on the screen.

11. If you have problems seeing the cursor on the CRT, then you should

    (a) refine the picture by adjusting brightness and other controls.
    (b) check all leads and plugs for snug fit.
    (c) move the computer away from nearby appliances.
    (d) all of the above.

12. When the "∅/∅" report code appears at the bottom of the screen, it means

    (a) the command was successfully completed.
    (b) the computer is unable to complete the command.
    (c) either the command was completed or the computer was unable to complete the command.
    (d) there is no more memory available for data storage.

13. In order to delete a character in a line, the cursor must be

    (a) to the left of the character.
    (b) immediately above the character.
    (c) immediately below the character.
    (d) to the right of the character.

14. The "K" cursor allows you to

    (a) enter keywords only.
    (b) enter operands only.
    (c) enter line numbers only.
    (d) enter either keywords or line numbers.

15. CLS is the same as

    (a) "clear the screen."
    (b) CLASS.
    (c) computer list on screen.
    (d) none of the above.

16. The way to command the computer to automatically display the program beginning with the first statement, you should

    (a) enter a PRINT command.
    (b) enter a STOP command.
    (c) enter a LIST command.
    (d) enter a RUN command.

17. In the FUNCTION mode, the "F" cursor

    (a) remains locked in until the operator releases it.
    (b) lasts for only one key depression.
    (c) never appears because the "G" cursor is in control.
    (d) is used strictly for entering PRINT commands.

18. In order to use the letter and number characters on the keyboard,

    (a) the "K" cursor must be showing.
    (b) the "L" cursor must be showing.
    (c) the "S" cursor must be showing.
    (d) the "G" cursor must be showing.

19. If the "K" cursor does not appear on the CRT screen immediately after turning on the system, you should

    (a) unplug and plug in your computer two or three times.
    (b) check all leads/connections.
    (c) unhook the antenna connection to the CRT Computer Switch Box.
    (d) turn the TV off, then on.

20. For purposes of programming, the CRT screen may be considered a grid composed of

    (a) 500 spaces.
    (b) 614 spaces.
    (c) 704 spaces.
    (d) 825 spaces.

WHEN YOU HAVE COMPLETED THE ENTIRE EXAM, TRANSFER YOUR ANSWERS
TO THE ANSWER SHEET WHICH FOLLOWS.

ICS

Subject __PRACTICAL PROGRAMMING IN BASIC__ Course____

Student's Reference

Letters / Figures

Serial Number: 2 4 7 0 5
Test No: 5
Ed No: 2

Tutor's Comments | Grade | Tutor

Name

Address

Post Code

After studying the foregoing questions, record your answers in
the matrix below by writing a cross (X), in ink, through the
letter which you consider to be the correct answer. Submit
ONLY this answer sheet to the School for correction DO NOT
SUBMIT THE QUESTION SHEET. All questions must be attempted.

1.	A	B	C	D	E
2.	A	B	C	D	E
3.	A	B	C	D	E
4.	A	B	C	D	E
5.	A	B	C	D	E

11.	A	B	C	D	E
12.	A	B	C	D	E
13.	A	B	C	D	E
14.	A	B	C	D	E
15.	A	B	C	D	E

6.	A	B	C	D	E
7.	A	B	C	D	E
8.	A	B	C	D	E
9.	A	B	C	D	E
10.	A	B	C	D	E

16.	A	B	C	D	E
17.	A	B	C	D	E
18.	A	B	C	D	E
19.	A	B	C	D	E
20.	A	B	C	D	E

CUT HERE

VHF ANTENNA CONNECTOR

This item is not included with Personal Computer Kit because it is
quite unsuitable for SA TVs, and cannot be modified satisfactorily.
It is only a cosmetic switch and makes absolutely no difference to
the operation of the TIMEX 1500. For the technically minded, the
Antenna Connector matches the standard US 300 ohm antenna line to
the computer's 75 ohm connector line.

CONNECTING UP

Disconnect the TV aerial plug and replace it with the CRT Connector
lead. In step 11 of the instructions, you may not get a blank
screen with a K at the bottom. Do not despair! Did you press key 3?

TUNING THE TV

On the control panel of your TV there is a little door or removable
panel. Open the door or remove the panel - you won't get a shock
or damage the TV. Behind the panel is a number of little wheels
or knobs - some knobs are so tiny or badly placed that they have to
be turned with a small insulated screwdriver. Each small wheel has
a number against it to correspond with the channel selector button.
Also, alongside each wheel you will notice a little pointer which
moves as the wheel is turned. Again, there may be a small switch
labelled A B C or a small plug which can be inserted in one of three
positions. First of all, select a channel which is not tuned for
your normal TV viewing. If all channels are used, then select the
channel with the highest number - say, 10. Depress the button to
select 10. Don't forget to press key 3.

Now put the small switch over to C or swap the plug over to the third
position. Slowly move the small wheel until the 'mush' on the
screen is replaced by a blank screen. You may have to experiment with
the switch positions a little but ultimately you will get a blank
screen with the K cursor in the corner.

VERTICAL HOLD

You may be unlucky enough to possess a TV slightly off tune with the
computer. In this case, one or more black lines will move up the
screen at regular intervals although the K cursor can be seen. To
rectify this depends on your TV. Some TVs have a small knob on the
outside at the rear of the TV called the VH or Vertical Hold.
Adjust this slowly (it is very sensitive) until the black line dis-
appears - it gives the impression (although nothing can be heard) of
clicking into place out of sight.

Instead of the VH knob, there may be a hole into which a screwdriver
can be inserted to do exactly the same job. Use a small INSULATED
screwdriver to adjust it. If you cannot find either the knob or
the hole, telephone your TV dealer and ask him to advise you.

If this all sounds too complicated, get a friend to show you how to
adjust it or get your TV technician to do it for you.

TESTING

These computers are manufactured overseas and are constructed to
operate on the overseas TV frequencies which are slightly different
from ours, consequently adjustments have to be made. Although this
is a nuisance, once the adjustments have been made you should not
have any further trouble with screen presentation of your computer
operation.

Each computer is tested on our TV to ensure correct operation before
it is dispatched.